CLAIMS

What is claimed is:

1. A system for generating a slow-rise waveform to deliver defibrillation energy to terminate a cardiac fibrillation condition, the system comprising:

means for generating a slow-rise waveform to an predetermined amplitude;

means for converting the slow-rise waveform to an exponential decaying waveform for a predetermined period of time; and

means for truncating said slow-rise waveform upon the expiration of the predetermined period of time.

2. A system according to claim 1, wherein said slow-rise waveform comprises a one of the following:

a ramp-up waveform V, wherein V = mt,

an exponential rise waveform V, wherein V = exp(t / tau),

an exponential approach waveform V, wherein V = 1 – exp(-t/ tau); and

wherein said means for generating said slow-rise waveform comprises a switching power converter in operable electrical communication with at least one storage capacitor cell.

3. A system according to claim 2, wherein said exponential decaying waveform is truncated to a nominal voltage at a predetermined time.

4. A system according to claim 3, further comprising a second waveform having polarity opposite to the slow-rise waveform and means for transitioning from said slow-rise waveform to said second waveform at a predetermined time.

5. A system according to claim 1, wherein said means for generating the slow-rise waveform includes a pulse-modulating circuit.

6. A system according to claim 1, wherein said means for generating a slow-rise waveform to an predetermined amplitude includes an initial, relatively low amplitude step function from which the slow-rise waveform proceeds.

7. A system according to claim 4, wherein the second waveform comprises a lower amplitude slow-rise waveform.

8. A system according to claim 1, wherein the exponential decaying portion of the slow-rise waveform comprises an unmodulated capacitor discharge time function.

9. A system according to claim 1, further comprising at least pair of defibrillation electrode assemblies electrically coupled to the system at a proximal end and electrically coupled to a portion of cardiac tissue near a distal end portion and wherein said pair of assemblies includes at least one of the following: a percutaneous electrode, a subcutaneous electrode, an epicardial electrode, an endocardial electrode, a pericardial electrode, a transcutaneous electrode, a surface electrode, a canister electrode, a coil electrode, a ring electrode.

10. A system according to claim 4, wherein said slow-rise waveform includes a characteristic tilt of between approximately 50% and 75%.

11. A system according to claim 10, wherein said second waveform includes a characteristic tilt of between approximately 50% and 75%.

12. A system according to claim 4, wherein said second includes an initial, relatively low amplitude step function and said second waveform has a characteristic tilt of between approximately 50% and 75%.

13. A system according to claim 12, wherein said second waveform comprises a second slow-rise waveform following said initial, relatively low amplitude step function.

14. A system according to claim 13, wherein said second slow-rise waveform is followed by an exponential decay portion which in turn is followed by a truncated portion.

15. A method of delivering at least one complex defibrillation waveform to a portion of cardiac tissue, comprising the steps:

confirming the presence of a cardiac arrhythmia terminable by delivery of a defibrillation waveform;

generating at least one pulse-modulated slow-rise defibrillation waveform portion until said slow-rise defibrillation waveform portion reaches a predetermined amplitude;

allowing the amplitude of the defibrillation waveform to decay exponentially for either a predefined period of time or until a predetermined voltage threshold is reached;

truncating said defibrillation waveform; and

providing said defibrillation waveform to a portion of cardiac tissue.

16. A method according to claim 15, further comprising the steps:

after the truncating step, generating a second defibrillation waveform of opposite polarity to said at least one pulse-modulated slow-rise defibrillation waveform; and

providing said second defibrillation waveform to the portion of cardiac tissue.

17. A method according to claim 16, wherein said second defibrillation waveform comprises an initial slow-rise defibrillation waveform portion.

18. A method according to claim 17, wherein said initial slow-rise defibrillation waveform portion is followed by an exponentially decaying portion, and said decaying portion if followed by a truncated portion.

19. A method according to claim 15, further comprising the steps of determining whether the cardiac arrhythmia has terminated, and if not, repeating the steps of claim 15 at a higher magnitude predetermined amplitude.

20. A method according to claim 15, further comprising the initial step of generating a relatively low amplitude step function prior to generating the pulse-generated slow-rise defibrillation waveform, and wherein said pulse-generated slow-rise waveform is generated beginning from the relatively low amplitude step function.

21. A method according to claim 15, wherein a total duration of said defibrillation waveform includes a range of approximately 13 ms to approximately 28 ms.

22. A method according to claim 15, wherein said pulse-modulated slow-rise waveform is generated by a high speed, power switching converter.

23. A method according to claim 22, wherein the slow-rise defibrillation waveform includes one of a voltage-controlled waveform and a current-controlled waveform.

24. A computer readable medium for storing executable instructions for performing a method of delivering at least one complex defibrillation waveform to a portion of cardiac tissue, comprising:

instructions for confirming the presence of a cardiac arrhythmia terminable by delivery of a defibrillation waveform;

instructions for generating at least one pulse-modulated slow-rise defibrillation waveform portion until said slow-rise defibrillation waveform portion reaches a predetermined amplitude;

instructions for allowing the amplitude of the defibrillation waveform to decay exponentially for either a predefined period of time or until a predetermined voltage threshold is reached;

instructions for truncating said defibrillation waveform; and

instructions for providing said defibrillation waveform to a portion of cardiac tissue.

25. A medium according to claim 24, further comprising:

after the truncating step, instructions for generating a second defibrillation waveform of opposite polarity to said at least one pulse-modulated slow-rise defibrillation waveform; and

instructions for providing said second defibrillation waveform to the portion of cardiac tissue.

26. A medium according to claim 25, wherein said second defibrillation waveform comprises an initial slow-rise defibrillation waveform portion.

27. A medium according to claim 26, wherein said initial slow-rise defibrillation waveform portion includes a segment followed by an exponentially decaying portion, and said decaying portion includes a segment followed by a truncated portion.

28. A medium according to claim 24, further comprising:

instructions for determining if the cardiac arrhythmia has terminated, and if not, instructions for repeating the steps of claim 24 at a higher magnitude predetermined amplitude.

29. A medium according to claim 24, further comprising:

instructions for generating a relatively low amplitude step function prior to generating the pulse-generated slow-rise defibrillation waveform, and wherein said pulse-generated slow-rise waveform is generated beginning from the relatively low amplitude step function.

30. A medium according to claim 24, wherein a total duration of said defibrillation waveform is in the range of approximately 13 ms to approximately 28 ms.

31. A medium according to claim 24, wherein said pulse-modulated slow-rise waveform is generated by a high speed, power switching converter.

32. A method according to claim 31, wherein the slow-rise defibrillation waveform is either a voltage-controlled waveform or a current-controlled waveform.